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# CANADIAN PATENT

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SNOWMOBILE SKI

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No. OF CLAIMS 6

This invention relates to snowmobile skis, and more particularly to a keel having a hardened wear rail removably clamped to the underside of a snowmobile ski runner.

The steering of snowmobiles is conventionally accomplished by a pair of ground engageable skis which are mounted on the front of the snowmobile and are turned in the direction in which the snowmobile is to be propelled. The turning radius of a snowmobile which is equipped with conventional skis, traversing very hard snow or ice is very large because the conventional ski runners merely slide along the surface without "digging in". To overcome this, snowmobile skis are provided with skags or keels on the underside thereof, having sharpened carbide wear rails which cut or bite into the hardened surface to positively control the turning of the snowmobile. The ability to positively control the path of movement of the snowmobile becomes particularly important in racing at high speeds.

When a carbide wear rail becomes worn, it is important that the skag assembly be so constructed that only the worn wear rail need be discarded and a substitute wear rail installed in its place. Accordingly, it is an object of the present invention to provide a snowmobile ski having a hardened wear rail removably clamped to the underside thereof to permit the hardened wear rail to be replaced by a substitute rail.

The wear rail, which is conventionally formed of carbide and is generally much harder and more brittle than the mounting member for the carbide rail, will crack or break upon sharp impacts. It has been found that if the upper leading edge of the hardened wear bar is protected, the incidence of breakage is reduced. Accordingly, it is an object of the present invention to provide a snowmobile ski runner having a hardened wear rail on the underside thereof and a guard which will protect the leading edge of the wear rail. Although it is important that the hardened wear rail be releasably clamped to the underside of the ski runner to permit



its quick removal, it is imperative that the wear rail cannot be inadvertently dislodged from a ski runner mounted on a racing-type snowmobile. If the wear rail on a racing snowmobile is dislodged, the delay in halting the snowmobile and installing new wear rails can cause a snowmobile racer the loss of the race.

The skis on racing snowmobiles are subjected to particularly large stresses and repeated jarring which tends to dislodge the wear rail. The inadvertent loss of a wear rail when traveling at high speeds represents a safety hazard. If a racer attempts a sharp turn at high speeds without a wear rail, he will lose his steering capability which could cause him to leave the track and possibly hit other racers. Accordingly, it is another object of the present invention to removably couple a hardened rail to the underside of a snowmobile ski and positively preclude the wear rail from being jarred loose from the underside of a snowmobile ski.

It is yet another object of the present invention to provide a snowmobile ski rail having a hardened wear rail positively coupled thereto by elongate key members.

It has been found that the handling characteristics of some snowmobiles improve as the wear rails are moved to different locations along the underside of the ski. On some occasions, the machine will handle better if the wear rail comprises longitudinally spaced sections separated by a gap underlying the king pin. Accordingly, it is still a further object of the present invention to provide a keel for a snowmobile ski runner having interchangeable parts which permits a hardened wear rail mounted thereon to be positioned substantially anywhere along the underside of the ski runner.

Yet another object of the present invention is to provide a keel for a snowmobile ski having a pair of clamp members removably coupled to a hardened wear rail and adapted to be removably coupled to the underside of the ski runner.

Other objects and advantages of the present invention

will become apparent as the description thereof proceeds.

A keel adapted to be mounted on the underside of a longitudinal, snowmobile ski runner comprising: a wear rail for engaging the surface to be traversed; a pair of opposed, separable, clamp members for removably clamping opposite sides of the wear rail; means for removably mounting the clamp members on the underside of the runner; and key means reacting between the wear rail and the clamp members for releasably preventing relative vertical movement of the clamp members and the wear rail.

10           The present invention may more readily be understood by reference to the accompanying drawings, in which:

Figure 1 is a sectional side view, taken on the line 1-1 of Figure 2, of a snowmobile ski constructed according to the present invention;

Figure 2 is an enlarged sectional end view, taken on the line 2-2 of Figure 1;

Figure 3 is an enlarged sectional end view, taken on the line 3-3 of Figure 1;

20           Figure 4 is an enlarged sectional plan view, taken on the line 4-4 of Figure 3;

Figure 5 is a sectional side view, similar to Figure 1, of a slightly modified construction; and

Figure 6 is a sectional end view taken along the line 6-6 of Figure 5.

A snowmobile ski constructed according to the embodiment shown in Figures 1-4 is generally designated 10 and includes a longitudinal ski runner, generally designated 12, and a skag or keel, generally designated 14, removably mounted on the underside thereof. The longitudinal ski runner 12 includes a longitudinal, flat body portion 16 having a longitudinally recessed, protuberance or rib section 18 and an upturned front end 15, as usual. The  
30           skis 10 are particularly adapted for use on a snowmobile (not shown) including a pair of laterally spaced, depending king pins

24 each supported on a ski 10 by a leaf spring assembly 22 connected to the king pin 24 by a spring mount 26 and supported by a pair of longitudinally spaced shackles 20 fixed to the upper side of a ski 10. The longitudinally recessed rib section 18 will be embedded in the snow when the snowmobile is traversing relatively soft snow to control the direction of travel of the snowmobile.

To assist in controlling the direction of travel when the machine is traversing ice or relatively hard snow, the skag or keel 14 is provided and includes a pair of identical clamp members 28 10 removably coupled to opposite sides of a wear rail 27 by a plurality of bolts 30, received in aligned apertures 31 provided in the clamp members 28, and nuts 30a removably threaded thereon. The clamp members 28 are removably coupled to the underside of the rib 18 by a plurality of T-bolts 32 having enlarged heads 35 received in semi-cylindrical confronting cutouts 37 provided on the inner surfaces of the clamp members 28. The T-bolts 32 include threaded shanks 32a received in a plurality of longitudinally spaced apertures 33 provided in the rib 18 and secured thereto by a plurality of nuts 34. The top surfaces 28a of the clamp members 28 are flat 20 to provide increased bearing surfaces which minimize roll of the skag 12 about its longitudinal axis and eliminate the need for a reinforcing "fish plate" between the underside of the ski runner 16 and the top of the clamp members 28.

The clamp members 28 each include a longitudinal notch 36 along the lower inside surface thereof in confronting relation with the cutout or notch 36 of the other clamp member 28 to define a downwardly opening, longitudinally extending slot receiving the longitudinally, extending, wear rail blank 27 which may conveniently be formed of hardened material such as carbide. A pair of 30 semi-cylindrical, longitudinal recesses 42 are formed in opposite sides of the wear rail blank 27 in confronting relation with a pair of semi-cylindrical, longitudinal recesses 44 formed in the inside vertical faces of the notches 36 to define longitudinal

keyways for receiving a pair of longitudinal, cylindrical keys 46 which positively prevent the carbide blank 27 from being dislodged from the clamp members 28 when the clamps are in the clamping positions illustrated in Figures 2 and 3. The lower portions of the clamps 28 converge downwardly as illustrated at 28b. The keyway recesses 44 are cold rolled in the clamp members 28 by a pair of opposing, rotatable roller pressing members (not shown) between which the clamp members are individually passed. One of the roller members includes an annular forming rib which forms the groove or  
 10 keyway portion as the clamp members are passed between the rollers.

The clamps 28 may be conveniently constructed of steel having a hardness rating of 22-25 on the Rockwell RC hardness scale, but the rail 27 comprises carbide which is substantially harder than steel and has a hardness rating of 88.2-92.4 on the Rockwell RC hardness scale. The carbide rail 27 is very thin, i.e. 3/32 inches wide, very brittle, and subject to breakage on sharp impact. To minimize breakage of the rail 27, the leading and trailing edges are beveled, as indicated by the reference characters 29 and 31, at an angle of 30° to 45° to the horizontal to enable the rail to  
 20 glide over obstructions without absorbing their full impact as the snowmobile is traveling.

The leading and trailing ends 55 of the clamp members 28 include confronting, semi-cylindrical recesses 62 for receiving the ends 64 of a pair of coupling rods 52 removably coupled thereto by bolts 54 and nuts 54a. The free ends 56 of the coupling rods 52 are received in longitudinally, spaced, front and rear apertures 60 provided in the underside of the ski runner 12. The uppermost portions 29a and 31a of the leading and trailing edges 29 and 31, respectively, are protected from hitting obstructions in the path  
 30 of the rail by the lower portions 51 of the coupling rods 52. The lower portions 51 of the coupling rods 52 also define thrust shoulders preventing longitudinal movement of the wear rail 27 relative to the clamp members 28. The lower portion of the carbide

blank converges downwardly to a relatively sharp edge 47 to form an included angle between the side faces of the blank, of  $60^{\circ}$  to  $120^{\circ}$ .

As illustrated in the drawing, the wear rail 27 comprises a pair of identical sections 41 and 43 which can be selectively interchanged with each other. The leading end 29 of the leading rail 41 will tend to wear quicker than the trailing end 31 on the trailing rail 43. The positions of the rail sections 41 and 43 can be interchanged after the front rail becomes partially worn so that the two rails will have approximately the same useful life.

- 10 The positions of the wear rail sections 41 and 43 can be interchanged by merely turning the entire skag or keel 12 end for end or uncoupling the clamp members 28 from the coupling rods 52 and turning the wear bar supporting clamp members 28 end for end. The wear rail sections 41 and 43 can also be unclamped by loosening bolts 30 and nuts 31 and interchanged.

- 20 The concept of coupling and decoupling the coupling rods 52 to the clamp members 28 is particularly important to enable differing length wear rails 27 and clamp members 28 to be coupled to the underside of the ski 12. For instance, a wear rail 27 of substantially shorter length than that shown in Figure 1 could be utilized by merely utilizing coupling rods 52 of a length longer than the length of the rods shown in Figure 1. On the other hand, the clamp members 28 and the wear rail blank 27 illustrated in the drawing could be replaced by pairs of longitudinally spaced clamps gripping longitudinally spaced rail rods and a coupling rod (not shown) would span the pairs of clamp members. Accordingly, any number of different combinations of different length and number of coupling rods and skags could be utilized depending upon the characteristics of particular snow machine under consideration.

- 30 By coupling the clamp members 28 to the ski with the connecting rods 52 in addition to the bolts 32, a much safer and reliable system is provided. In the event that the bolts 32 break, the wear rail 27 will track behind the front connecting rod 52.

When a snowmobile turns, the ski 10 will cant about its longitudinal axis. To assist in turning, it is sometimes desirable to mount a skag or keel 14' (Figure 2) on the underside of the side portions of the ski runner 16. As the snowmobile negotiates a turn and the ski is canted, the skag 14' will be moved downwardly to engage the ice and snow. Coupling rods 52 need not be utilized with the keel 14' which is connected to the underside of the runner only by the T-bolts 32 and the nuts 34.

The keels 14 constructed according to the present invention may be used on existing snow machines which have conventional 3/8 inch diameter one piece wear rods similar to connecting rods 52 extending along the underside of the ski between recesses 60. The existing one piece wear rod would be replaced by two, relatively shorter coupling rods 52. The use of keel apparatus constructed according to the present invention, as opposed to the conventional wear rods, provides a substantially safer operating snowmobile and this is always important to snowmobile operators.

The snowmobile ski 10 is assembled by connecting the coupling rods 52 to the front and rear ends 55 of the clamp members 28 by bolts 54 and inserting the carbide wear rail blank 27 in the slot defined by the longitudinally extending notches 36 at the bottom of the clamp members 28 and inserting the T-bolts 32 received in the confronting notches 36 at the top of the adjacent clamp members 28.

The longitudinally extending keys 46 are then inserted in the keyways defined by the longitudinal, confronting keyway portions 42 and 44. The nuts 30a are tightened on the bolts 30 to positively clamp the keys in position to prevent the wear rail blank 27 from moving vertically. The clamp members 28 and coupling rods 52 are bowed outwardly and the rod ends 56 are positioned in the apertures 60 in the underside of the ski runner 12. When the clamp members 28 and the connecting rods 52 are permitted to return to their original unbowed condition, the rod ends are



received in the apertures 60 and the T-bolts 32 are received in the apertures provided in the underside of the ski runner 16. The rail 27 is prevented from moving longitudinally by abutting the lower portions 51 on the connecting rods 52.

When the leading edge 29 of the wear rail 27 becomes worn with use, the skag 10 is removed from the underside of the runner 16 and turned end for end so that the formerly trailing edge 31 is now the leading edge and the former leading edge 29 is now the trailing edge. In the event that one of the carbide sections 41 or 43 breaks, only the broken section need be removed and replaced with an identical section. The unbroken portion of the broken section can be salvaged for future use with other wear rail sections 41 and 43. The concept of reusing the salvaged material represents a substantial savings of the relatively expensive carbide material.

The skags 14' are installed with stub shaft portions 52' being substituted for the coupling rods 52. The stub shaft portions do not extend into the apertures 60 but include lower shoulder-defining portions 51' in prolongation with the upper leading and trailing edge portions 29a and 31a providing protection for the upper portions 29a and 31a of the leading and trailing wear rail edges.

It should be noted that the underside of the wear rail could be curvilinear so that the snowmobile is riding on the snow with substantial point contact.

Referring now more particularly to Figures 5 and 6, an alternate embodiment is illustrated wherein one clamp member 28' is coupled to an identical clamp member by bolts 30' and nuts 30a'. Parts corresponding to parts of the apparatus illustrated in Figure 1 are identified by identical numerals followed by a prime designation. One of the clamp members 28' is removably coupled to the underside of the ski runner 12' by means of a bolt 32', fixed to the top of one of the clamps 28', and a nut 34'. A wear rail, generally designated 27', is provided and comprises a

plurality of generally flat, cylindrical discs 60 having circumferentially outer sides 61 and 62 converging to a sharp annular edge 63 which engages the surface being traversed. As the undersides of the discs 60 become worn, the disc retaining nuts 30a are loosened from the bolts 30 and the discs 60 can be individually rotated to expose the unworn portions to the surface being traversed.

It is to be understood that the drawings and descriptive matter are in all cases to be interpreted as merely illustrative of the principles of the invention, rather than as limiting the same in any way, since it is contemplated that various changes may be made in various elements to achieve like results without departing from the spirit of the invention or the scope of the appended claims.

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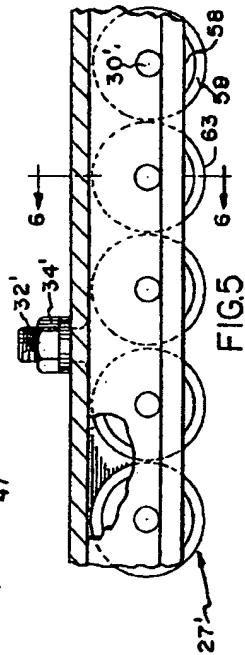
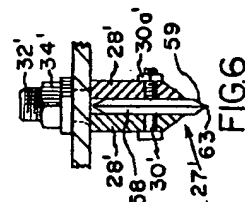
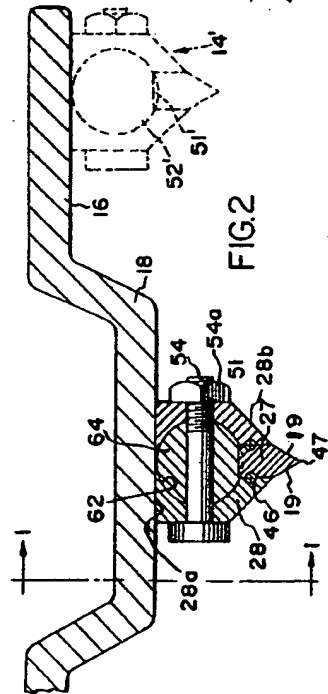
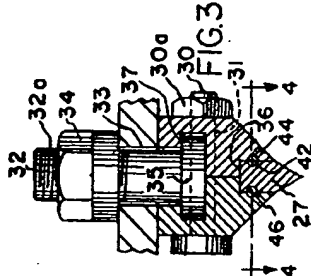
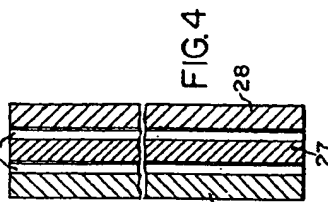
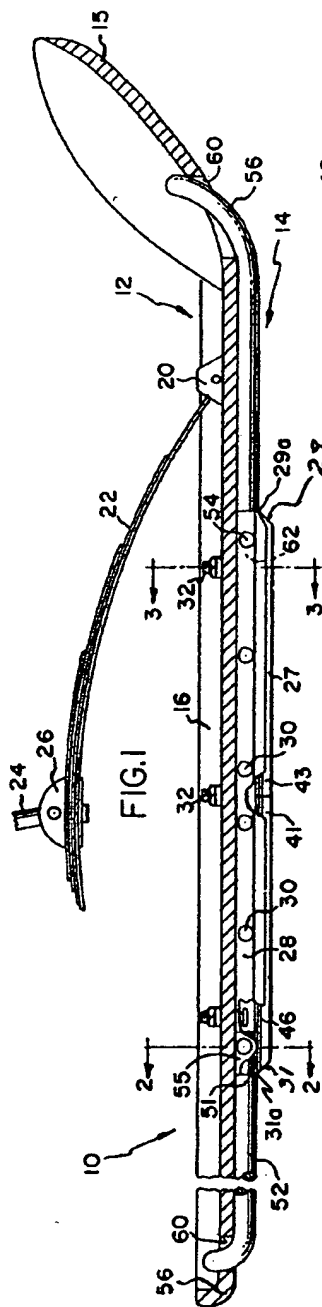
THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A keel for use on the underside of a longitudinally extending snowmobile ski runner including: a wear rail for engaging a surface to be traversed; opposed, transversely separable, clamp members for clamping opposite sides of said wear rail; means for removably mounting said clamp members on the underside of said runner; means reacting between the clamp members for removably holding said clamp members in clamping positions on opposite sides of said wear rail; and longitudinally extending key means disposed between said wear rail and said clamp members for preventing relative vertical movement of said clamp members and said wear rail.
2. The keel set forth in claim 1 wherein said key means comprises longitudinal, confronting keyway passages provided in the side portions of said wear rail and inner surfaces of said clamp members, and a longitudinally extending key member removably disposed in said passages to releasably lock said clamp members and said wear rail together.
3. The keel set forth in claim 2 wherein said clamp members include generally flat top surfaces for engaging the underside of said runner and longitudinal, confronting bottom grooves cooperating to define a downwardly open slot receiving the upper portion of said wear rail, the lower portion of said wear rail being disposed below said clamp members and being of a width no greater than the width of said slot.
4. The keel set forth in claim 1 wherein said wear rail comprises a blank having an upper portion with a pair of longitudinally extending recesses in opposite sides thereof and a lower portion having downwardly converging sides, said clamp members including longitudinal, confronting grooves along the lower edge portions thereof provided with longitudinally extending recesses in confronting relation with said first mentioned recesses to define a pair of keyways, and a pair of longitudinally extending key members in said keyways constituting said key means.

5. The keel set forth in claim 1 wherein said means for removably mounting said clamp members on the underside of said runner includes front and rear connector rods removably coupled to the front and rear ends of at least one of said clamp members and adapted to be connected to the front and rear portions of said runner.

6. The keel set forth in claim 5 wherein said front connector rod includes a portion in prolongation with the upper portion of the forward leading edge of said wear rail to protect said rail against breakage.





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